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09/966,689	09/27/2001	Shunpei Yamazaki	07977/286001/US5247	5005

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EXAMINER

CHEN, KIN CHAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 03/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/966,689

Applicant(s)

YAMAZAKI ET AL.

Examiner

Kin-Chan Chen

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The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 February 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 26-28 is/are allowed.
- 6) ☒ Claim(s) 15-25 and 29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION**

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 15-25 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Susko et al. (US 4,885,074; hereinafter "Susko") in view of Sill et al. (US 6,431,112 B1; hereinafter "Sill") and Dible et al. (US 5,824,606; hereinafter "Dible").

Susko teaches an etching method using a dry etching apparatus provided with an upper electrode and a lower electrode being opposed to the upper electrode. The lower electrode comprises a plurality of electrodes. A plurality of electrodes are provided below the substrate (high-power sources being independent from each other, e.g., claim 22) in a chamber. A reaction gas may be supplied into the chamber. A first high-frequency power may be applied to an electrode disposed below a central portion of the substrate and second high-frequency power may be applied to the electrode (or electrodes) disposed below the edge portions of the substrate to supply an AC electric field between the first electrode and second electrode and third electrodes. The plasma may be generated (with a magnetic field or an electric field, claim 18) between the first electrode and the second and third electrodes. A plurality of high power sources independently connected to each of the plurality of electrodes (claim 22). A material film

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on the substrate may be etched. (col. 3, lines 32-54; col. 4, lines 16-32 and Figs 3-6; col. 5, lines 7-21). The wafer can be processed uniformly and the etching from the center of workpiece and the edges of workpiece has the same extent (col. 4, lines 30-32; col. 5, lines 18-20).

Susko discloses that the plasma reactor is capable of sustaining a vacuum (abstract). Susko does not explicitly state supplying a reaction gas into the chamber under a reduced pressure. However, it is conventional for the plasma etching process. Sill is relied on to show that in the plasma processing (e.g., plasma etching), a reaction gas is supplied into the chamber under a reduced pressure (under vacuum) (col. 5, lines 33-37, lines 53-62). Because it is a conventional method in the art of plasma etching and because it is disclosed by Sill, hence, it would have been obvious to one with ordinary skill in the art to perform said process step of Susko under reduced pressure as taught by Sill in order to provide their art recognized advantages and produce an expected result.

Susko teaches that the workpiece can be a semiconductor device or any structure to be etched (col. 1, lines 51-53). Susko is not particular about the shape or structure of the workpiece, therefore, it would have been obvious to one with ordinary skill in the art to use workpiece with conventional shapes (e.g., round, rectangular, or square substrates). Hence, **the edges of the substrate comprise the corner portions of the substrates**, as instantly claimed, wherein the electrodes may be disposed.

Susko teaches that the electrode structure may be a sample holder and suitable and conventional mounting mechanisms would be normally used (col. 4, lines 64-65;

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col. 3, lines 45-46). Therefore, the substrate may be deposited on the plurality of electrodes (e.g., second and third electrodes in claims 15, 22, 24; first and second electrodes in claims 20, 26, 27). The instant claims differ from Susko by specifying the plurality of electrodes below the substrate may be flush with each other. However, in order to generate an uniform field of energized gas for plasma processing and etch material from the center of a workpiece to the same extent as the edges, Susko specifically points out that **any configuration of electrodes relative to one another and relative to a workpiece can be devised** in accordance with the present invention depending on the purpose for which the reactor chamber is used and particular operating requirements (col. 5, lines 41-48). Hence, it would have been obvious to one with ordinary skill in the art to adjust the layout of electrodes such as flush with each other as claimed because Susko teaches that **any configuration of electrodes relative to one another and relative to a workpiece can be devised** to generate an uniform field of energized gas for plasma processing.

The combined prior art reads on the new added limitation "plasma wider than the width of the upper electrode is generated between the upper electrode and the lower electrode" because in the plasma chamber, the plasma (ionized gas) simply is present, could be any location, inside of the chamber since inside of the chamber is an open environment. Also see Fig. 5 of Susko.

Susko teaches that the workpiece can be a semiconductor device or any structure to be etched (col. 1, lines 51-53). Susko is not particular about the shape or structure of the workpiece, therefore, it would have been obvious to one with ordinary

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skill in the art to use workpiece with multiple patterns on it because it is common that substrate has multiple patterns with pixels in semiconductor device, see Boegli et al. (US 6,259,106) and Rishton S. et al. (US 6,556,702) in the record as evidences.

The instantly claimed invention differs from Susko and Sill by specifying the upper electrode is a coil electrode. Susko and Sill is not particular about the upper electrode. Hence, it would have been obvious to one with ordinary skilled in the art to use coil electrode because it is one of the most popular upper electrode used in the art of plasma etching. Dible ( Fig. 2; col. 11, lines 36-38) is only relied on to show this well-known feature (also see Abraham et al. (US 5,883,007) and Nishizawa (US 4,233,109) in the record as evidences). Thus, it would have been obvious to one with ordinary skilled in the art to use the coil electrode as upper electrode in Susko and Sill because it is disclosed by Dible and because it is one of the most popular upper electrode used in the art of plasma etching.

As to dependent claim 16, Susko teaches using the first high-frequency power and the second high-frequency power. Susko does not disclose the frequency used in its process. It would be obvious to one skilled in the art to use standard 13.56 MHz frequency (see El-kareh (FSPT, p. 285) in the record as evidence) for both power sources because it is extra cost without benefit to use different frequencies for power sources.

As to claim 20, Susko teaches that the workpiece can be a semiconductor device or any structure to be etched. Susko is not particular about the structure of the workpiece being etched, therefore, it would have been obvious to one with ordinary skill

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in the art to use workpiece with conventional wiring structure of semiconductor device, such as a conductive film formed on the substrate with a mask formed on the conductive film. Hence, it would have been obvious to one with ordinary skill in the art to perform said process steps of Susko in the conventional wiring structure in order to provide their art recognized advantages and produce an expected result.

Claim 29 differs from the combined prior art by specifying five electrodes rather than three electrodes or four electrodes below the substrate in Susko. However, Susko teaches that in order to create an uniform plasma field, it is advantageous to provide a system having two or more independently controlled electrodes (col. 2, lines 49-51). Hence, it would have been obvious to one with ordinary skill in the art to have a plurality of electrodes, more than four electrodes as shown in Susko's example, depending on the reactor chamber and particular operating requirements in order to create an uniform plasma field. Claim 29 also specifies the second through fifth electrodes are located below corner portions of the substrate. However, as has been stated above, Susko specifically points out that **any configuration of electrodes relative to one another and relative to a workpiece can be devised** accordance with the present invention depending on the purpose for which the reactor chamber is used and particular operating requirements (col. 5, lines 41-48). Hence, it would have been obvious to one with ordinary skill in the art to adjust the layout of electrodes as claimed because Susko teaches that **any configuration of electrodes relative to one another and relative to a workpiece can be devised** to generate an uniform field of energized gas for plasma processing.

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Claims 17, 19, 21, 23, and 25 differ from the prior art by teaching various features well known to the art of semiconductor device fabrication (such as dry etching apparatus in claims 17, 19, and 23; wiring type in claim 21; electronic devices applications in claim 25). It is the examiner's position that a person having ordinary skill in the art at the time of the instantly claimed invention would have found it obvious to modify Susko, Sill and Dible by adding any of same well-known features to same because these features would have been anticipated to provide their art recognized advantages and thus produce an expected result. It is noted that applicant did not traverse the aforementioned conventionality (e.g., well-known features, conventional process steps), which have been stated in the office action in Paper No. 11).

### ***Response to Arguments***

3. Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

### ***Allowable Subject Matter***

4. Claims 26-28 are allowed.

### ***Conclusion***



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5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

El-Kareh, Fundamentals of Semiconductor Processing Technologies (FSPT), page 285, teaches that frequency typically 13.56 MHz is used in plasma etching system. Abraham et al. (US 5,883,007; col. 5, lines 35-41) or Nishizawa (US 4,233,109; col.7 and 8) teaches that coil electrode may be used as an upper electrode in the art of plasma etching. Boegli et al. (US 6,259,106; Fig. 3) and Rishton S. et al. (US 6,556,702; abstract and Fig. 3) teach workpiece (substrate) has multiple patterns with pixels on it for semiconductor device.

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

March 18, 2004



Kin-Chan Chen  
Primary Examiner  
Art Unit 1765

K-C C